

NEW SPECIES AND RECORDS OF NEW CALEDONIA *ALLUAUDOMYIA*
(DIPTERA: CERATOPOGONIDAE)

FRANCIS E. GILES AND WILLIS W. WIRTH

(FEG) Loyola College in Maryland, Baltimore, Maryland 21210; (WWW) Systematic Entomology Laboratory, BBII, Agricultural Research Service, USDA, and Florida State Collection of Arthropods, Florida Department of Agriculture and Consumer Services, P.O. Box 1269, Gainesville, Florida 32602.

Abstract.—Three new species of *Alluaudomyia* from New Caledonia are described: *epsteini*, *mouensis* and *poguei*. The hitherto unknown male of *A. melanesiae* Clastrier is described and figured, and new distribution records are given for this species and for *A. tillierorum* Clastrier. A key is presented for identification of females of the nine known species of *Alluaudomyia* Kieffer known to occur in New Caledonia.

The predaceous midges of the genus *Alluaudomyia* Kieffer are worldwide in distribution. The species of the southern hemisphere appear to be numerous but are as yet poorly known. Spinelli and Wirth (1984) list 23 Palearctic, nine Nearctic, and 31 Oriental species, compared with 17 Neotropical, 39 Afrotropical, and 27 Australasian species. Clastrier (1986) recently described six new species of *Alluaudomyia* from a small collection (15 specimens from six localities ranging from 30 to 850 m elevation) from New Caledonia. This is an example of the rich fauna awaiting study in the Pacific area. We recently received a large collection of ceratopogonids taken in New Caledonia in 1984 by Michael G. Pogue and Marc Epstein of the University of Minnesota in St. Paul. In the genus *Alluaudomyia* we studied 128 specimens from four localities ranging from 100 to 1200 m elevation. We segregated these into five species. Two had been described by Clastrier, and three are described here for the first time.

The *Alluaudomyia* species of the South Pacific are rather easily identified, due to

comprehensive revisions previously published by Tokunaga and Murachi (1959) for Micronesia, Wirth and Delfinado (1964) for the Oriental Region, Tokunaga (1963) for New Guinea, and Debenham (1971) for Australia and New Guinea. Wirth and Delfinado (1964) divided the Oriental species into five rather well-defined groups, but Debenham (1971) found these groups unworkable for the Australasian fauna.

After a comprehensive review of all the described species of *Alluaudomyia* worldwide, Clastrier settled on mathematical combinations of three female characters to arrange the species in eight artificial sections. These characters are: presence or absence of interfacetal pubescence on the eyes, number of spermathecae (one or two), and presence or absence of an appendix or diverticulum on the spermatheca near the base of the neck. Using this system Clastrier found that all the Palearctic and Neotropical species fell in his section 8 (*annulata*, *bella*, *maculipennis* and *xanthocoma* groups); the Afrotropical and Oriental species fell in four sections: 2, 5, 6, 8 (*an-*

nulata, *bella*, *maculipennis*, *marmorata* and *parva* groups); and the Australasian species were the most diverse, falling in six sections: 1, 2, 3, 5, 6, 8. No species have yet been found that would fall in Clastrier's sections 4 and 7. The New Caledonia species are all closely related, having a wing pattern with only two or three small black spots, all found on the radial veins, and only some vague dark streaks distally along the posterior veins in some species. All nine known New Caledonian species except one have diverticula on the spermathecae (Clastrier's sections 1, 2 and 3) and all except one have two spermathecae (Clastrier's sections 1, 2 and 6, the species with one spermatheca falling in Clastrier's section 3).

For explanation of terms, ratios, and measurements see Wirth and Delfinado (1964); morphological terminology follows Downes and Wirth (1981). All specimens listed were collected in new Caledonia at UV light by M. Pogue and M. Epstein, and were mounted on slides in phenol-balsam by the technique of Wirth and Marston (1968). Holotypes and allotypes of new species will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.; paratypes, as available, will be deposited in the following museums: Muséum National d'Histoire Naturelle, Paris; Australian National Insect Collection, CSIRO, Canberra; Bishop Museum (Honolulu); British Museum (Natural History), London; and California Academy of Sciences, San Francisco.

KEY TO FEMALES OF NEW CALEDONIAN SPECIES OF *ALLUAUDOMYIA*

- 1. Spermathecae without diverticulum *pacifica* Clastrier
- Spermatheca(e) with diverticulum 2
- 2. One spermatheca present; eyes with interfacetal hairs *bouchett* Clastrier
- Two spermathecae present; eyes with or without interfacetal hairs 3
- 3. Eyes bare 4
- Eyes pubescent 7
- 4. Yellowish species, thorax yellow on dorsal

- half; spermathecae hyaline *epsteini* Giles and Wirth
- Brownish species, thoracic dorsum brownish, at least in part; spermathecae pigmented 5
- 5. Spermathecae large, diameter 0.065-0.070 mm; scutum yellowish with prominent brown patches on anterior half *poguei* Giles and Wirth
- Spermathecae small, diameter 0.035-0.037 mm; scutum brownish, pale mottlings not prominent if present 6
- 6. Fore and mid tibiae with narrow brown band at midlength; wing with distinct linear dark spot over proximal portion of vein R1 *tillierorum* Clastrier
- Fore and mid tibiae with broad brown band at midlength; wing without dark spot over proximal portion of vein R1 *exigua* Clastrier
- 7(3). Fore and hind tibiae with broadly dark midportion and narrow pale bands on each side; scutellum brown except in midportion *mouensis* Giles and Wirth
- Fore and hind tibiae with narrow dark band at midlength and broad pale bands on each side; scutellum entirely pale 8
- 8. Scutellum with two pairs of setae in midportion, none laterally; scutum with one obscure pale area on each side, antennal ratio 0.83; palpal segments four and five with lengths in proportion of 20:27 *melanesiae* Clastrier
- Scutellum with two pairs of lateral setae, none in midportion; scutum with two pale areas on each side; antennal ratio 0.91; palpal segments four and five with lengths in proportion of 25:26 *neocaledoniensis* Clastrier

Alluaudomyia epsteini Giles and Wirth, NEW SPECIES

Fig. 1

A large pale yellowish species with contrasting dark brown lower half of pleuron and broad contrasting brown bands on legs; wing creamy yellowish with two small blackish anterior spots; eyes bare; spermathecae two, hyaline, with short diverticula; male gonostylus slender and bent hooklike on distal half, parameres with slender, ball-like tips.

Holotype female.—Wing length 1.52 mm; breadth 0.66 mm.

Head: Eyes contiguous, bare. Antenna

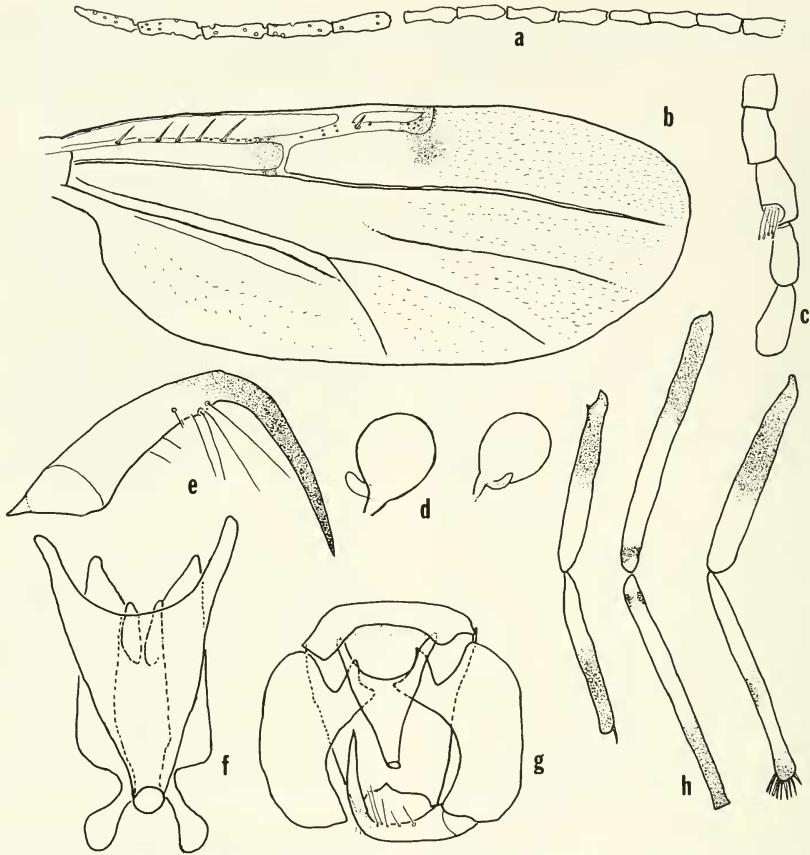


Fig. 1. *Alluaudomyia epsteini*, a-d, h, female; e-g, male: a, antenna; b, wing; c, palpus; d, spermathecae; e, gonostylus; f, aedeagus and parameres; g, genitalia, aedeagus and right gonostylus omitted; h, femur and tibia of (left to right) fore, mid, and hind legs.

(Fig. 1a) pale brown, narrow bases of flagellomeres 2-8 pale; flagellomeres with lengths in proportion of 20-17-16-16-16-17-18-19-21-23-23-22-22; antennal ratio (9-13/1-8) 0.80; sensilla basiconica present on flagellomeres 9-12. Palpus (Fig. 1c) brown; lengths of segments in proportion of 6-8-14-11-13; palpal ratio 2.3. Mandible with 11-12 teeth.

Thorax: Uniformly yellowish on dorsal

half, pleural and sternal areas dark brown. Legs (Fig. 1h) yellowish; coxae, trochanters and bases of femora dark brown; brown on proximal halves of fore and mid femora, proximal 0.6 on hind femur, mid femur with narrow apex blackish; tibiae with bases broadly pale except narrow blackish ring at base of mid tibia; apices of tibiae brown, distal 0.4 on fore tibia, 0.3 on mid tibia, and 0.25 on hind tibia; hind tibia with small

infuscation on extensor side at midlength. Tarsi pale, hind basitarsus dark; hind tarsal ratio 2.92. Claws long, slender and unequal on all legs.

Wing (Fig. 1b): Creamy white, veins only slightly infuscated; two prominent small black spots, first dark spot covering apex of costa and vein R4+5 and extending $\frac{1}{3}$ way caudad across cell r4+5; second spot proximal of r-m crossvein extending from vein R to vein M1+2. Costal ratio 0.61; macrotrichia numerous on distal portion of wing. Halter pale, knob slightly infuscated.

Abdomen: Pale brownish with ventral pigmented pattern on segments 3-7, last three segments yellowish, cerci whitish. Spermathecae (Fig. 1d) two, hyaline, with diverticula subequal in length to the slender, well-developed necks; slightly unequal, measuring 0.065×0.045 mm and 0.058×0.041 mm including necks, diverticula 0.007 mm long.

Male allotype.—Wing length 1.27 mm, breadth 0.42 mm; costal ratio 0.60. Similar to female with usual sexual differences. Antenna with flagellomeres 2-8 fused, plume brownish; lengths of flagellomeres in proportion of 39-18-19-17-16-17-15-15-23-48-48-42; antennal ratio (10-13/1-9) 0.94. Genitalia (Fig. 1g): Yellow, proximomesal and distolateral margins of gonocoxite brown; gonostylus brown on distal half. Ninth sternite with broad, shallow, caudo-median excavation, ventral membrane spiculate; ninth tergite hyaline, with short, bluntly pointed, divergent apicolateral processes. Gonocoxite strongly arcuate, bases stout and nearly meeting mesad, narrowed on distal half; gonostylus (Fig. 1e) slender, somewhat sickle-shaped but abruptly bent at midlength, with sharp-pointed tip, bearing 5-7 long slender setae along flexor margin. Aedeagus (fig. 1 f) with rounded basal arch extending to half of total length, basal arms dark brown; distal portion tapering to moderately slender, short, rounded tip abruptly bent ventrad. Parameres (Fig. 1f) separate, moderately stout and parallel on

proximal 0.6; narrowly constricted on distal third, the slender distal portion sinuately bent mesad, ventrad, and caudad and ending in swollen capitate tip.

Distribution.—New Caledonia.

Types.—Holotype ♀, allotype ♂, Mt. Dzumac, 760 m, 27.ii.1984. Paratypes, 19 ♀, 7 ♂, same data.

Discussion.—The species is named for Marc Epstein of the University of Minnesota in recognition of his interest and help in collecting New Caledonia ceratopogonids. Differs from related species by the characters given in the key.

Alluaudomyia poguei Giles and Wirth,

NEW SPECIES

Fig. 2

A relatively large yellow and brown mottled species; wing with two prominent anterior dark spots; scutum yellowish on posterior half, brownish anteriorly with prominent mottlings; legs with prominent pale and dark bands; eyes bare; spermathecae two, with short diverticula; male gonostylus sharp-pointed distally but not curving, parameres straight distally with slightly bilobed tips.

Holotype female.—Wing length 1.18 mm; breadth 0.50 mm.

Head: Brown; eyes narrowly separated to contiguous, bare. Antenna (Fig. 2a) pale brown, flagellomeres 2-8 narrowly pale basally; lengths of flagellomeres in proportion of 18-14-14-14-15-15-15-14-18-18-19-20; antennal ratio 0.78; sensilla basiconica present on flagellomeres 9-12. Palpus (Fig. 2b) brown, segment five darkest; lengths of segments in proportion of 5-8-12-10-11; segment three with small shallow pit bearing three long sensilla; palpal ratio 2.4. Mandible with 10-11 coarse teeth.

Thorax: Yellowish brown with dark brown mottling dorsad; anterior half of scutum dark brown with small yellowish patches; pleuron dark brown on lower half; scutellum yellowish, pale brown mesad; postscutellum brownish. Legs (Fig. 2c) yel-

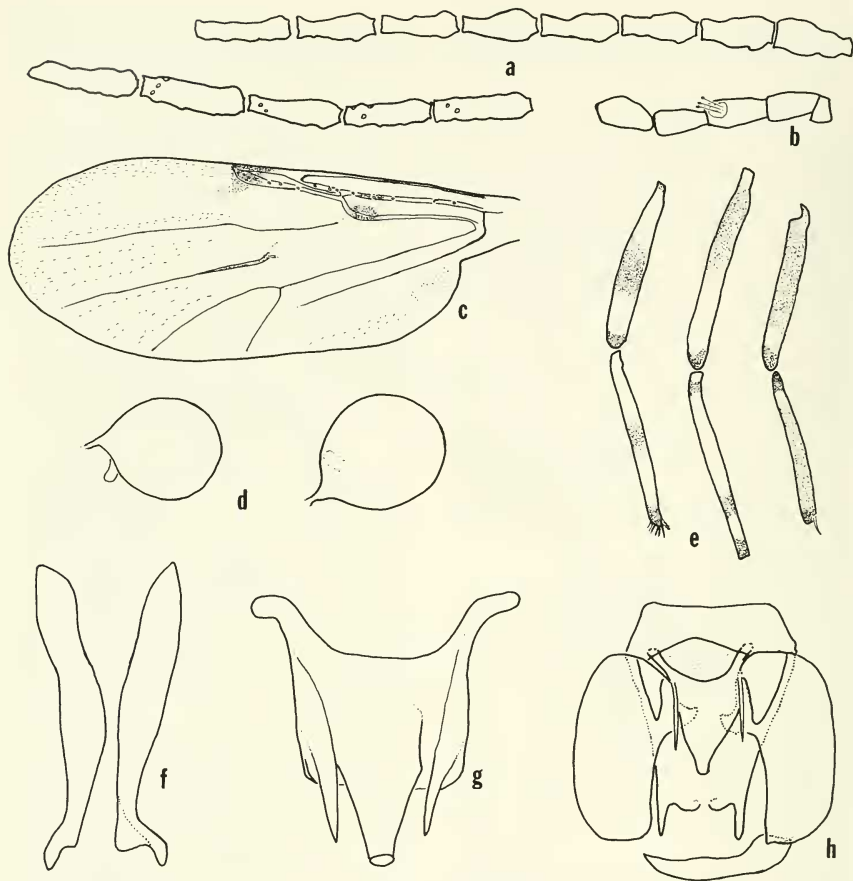


Fig. 2. *Alluaudomyia poguei*, a-e, female; f-h, male: a, antenna; b, palpus; c, wing; d, spermathecae; e, femur and tibia of (left to right) hind, mid, and fore legs; f, parameres; g, aedeagus; h, genitalia, aedeagus and right gonostylus omitted.

lowish; coxae and trochanters dark brown; femora with narrowly blackish apices; fore leg brownish with narrow pale rings sub-apically on femur and sub-basally on tibia; mid femur brownish with broad subapical pale band; mid tibia brownish with broad sub-basal and narrow subapical pale bands, a faint infuscation usually present at proximal third of length; hind femur brownish

with proximal half pale and narrow sub-apical pale ring; hind tibia pale with dark bands at midlength and at apex; tarsi pale, hind basitarsus dark. Hind tarsal ratio 2.36; tarsal claws long, slender, and unequal on all legs.

Wing (Fig. 2c): Two prominent small dark spots; first covering apex of costa and vein R4+5 and extending lightly in a caudolat-

eral direction; second dark spot extends from apex of vein M1+2 just before r-m cross-vein across apex of basal cell to include vein R; strong pigmentation along the lengths of medial and mediocubital veins and their branches and on anal vein. Costal ratio 0.55; six strong setae on vein R4+5 and eight on radial sector; macrotrichia numerous on distal half of wing. Halter pale, knob slightly infuscated.

Abdomen: Pale brown with dark mottling; ventral pigment pattern on segments 3–9; cerci pale. Spermathecae (Fig. 2d) two, heavily sclerotized, ovoid with diverticula subequal in length to the well-developed slender necks; slightly unequal, measuring 0.084×0.068 mm and 0.073×0.061 mm including necks.

Allotype male.—Wing length 1.16 mm, breadth 0.36 mm; costal ratio 0.51. Similar to the female with usual sexual differences. Antenna with lengths of flagellomeres in proportion of 26-10-10-10-10-10-10-10-10-15-26-28-25, antennal ratio (9–13/1–8) 0.76; flagellomeres 2–10 fused, plume yellowish brown. Hind tarsal ratio 2.40. Genitalia (Fig. 2h) brown, tergum nine hyaline distally. Sternum nine with shallow caudomedian excavation, ventral membrane with minute spicules; tergum nine tapering to rather broad, truncated tip with long slender parallel apicolateral processes. Aedeagus (Fig. 2g) with rounded basal arch extending to a fourth of total length; main body broad and tapering distally to bluntly pointed tip (as seen in allotype). In some specimens, apparently due to compression of cover-slip, the aedeagus appears broader and more quadrate, with two sublateral slender sclerotized blades separating out and flanking the slender, tapering, longer median process. Parameres (Fig. 2f) appearing as a pair of moderately stout straight sclerites, proximal portion of each spindle-shaped, tapering distally to a slightly expanded, twisted tip with ventrolateral lobe slightly longer than the low dorsomesal expansion.

Distribution.—New Caledonia.

Types.—Holotype ♀, Mt. Dzumac, 760 m, 27–28.ii.1984. Allotype ♂, same data but 16–17.i.1984. Paratypes, 44 ♀, 13 ♂, same data, both dates; 2 ♀, Ponandou River, 5 km S Touho, 22.ii.1984.

Discussion.—This species, the most abundant in our collections, is dedicated to Michael G. Pogue of the University of Minnesota in appreciation of his interest and cooperation in making available to us this superb ceratopogonid collection. Characters to separate *A. poguei* from related species are given in the key.

Alluaudomyia mouensis Giles and Wirth,

NEW SPECIES

Fig. 3a–c

A moderately large dark brown species with two-spotted wing, slightly infuscated along veins and membrane slightly dusky; eyes hairy; spermathecae two, small and subequal, each with moderately short diverticulum. Male unknown.

Female holotype.—Wing length 1.15 mm; breadth 0.50 mm.

Head: Dark brown. Eyes nearly contiguous, hairy. Antenna (Fig. 3a) dark brown; lengths of flagellomeres in proportion of 15-10-9-10-11-11-12-12-17-18-19-19-19, antennal ratio 0.98. Palpus (Fig. 3b) dark brown, short; lengths of segments in proportion of 5-10-13-9-12; third segment slender, palpal ratio 2.0, with five long sensilla borne in broad, irregular, very shallow pit. Mandible with 9–10 teeth.

Thorax: Dark brown, scutum somewhat darker punctate, scutellum lighter brown. Legs (Fig. 3c) dark brown, knee spots blackish; femora with narrow pale subapical rings; fore and mid tibiae with narrow sub-basal and subapical pale rings; hind tibia with broad sub-basal and subapical pale rings; tarsi pale, basitarsus dark; hind tarsal ratio 2.74. Claws slender and unequal on all legs, shortest on hind leg; lengths in proportion (fore, mid, hind) of 28:11, 28:11, and 20:7.

Wing (Fig. 3c): Slight infuscation on membrane and darker infuscated lines along

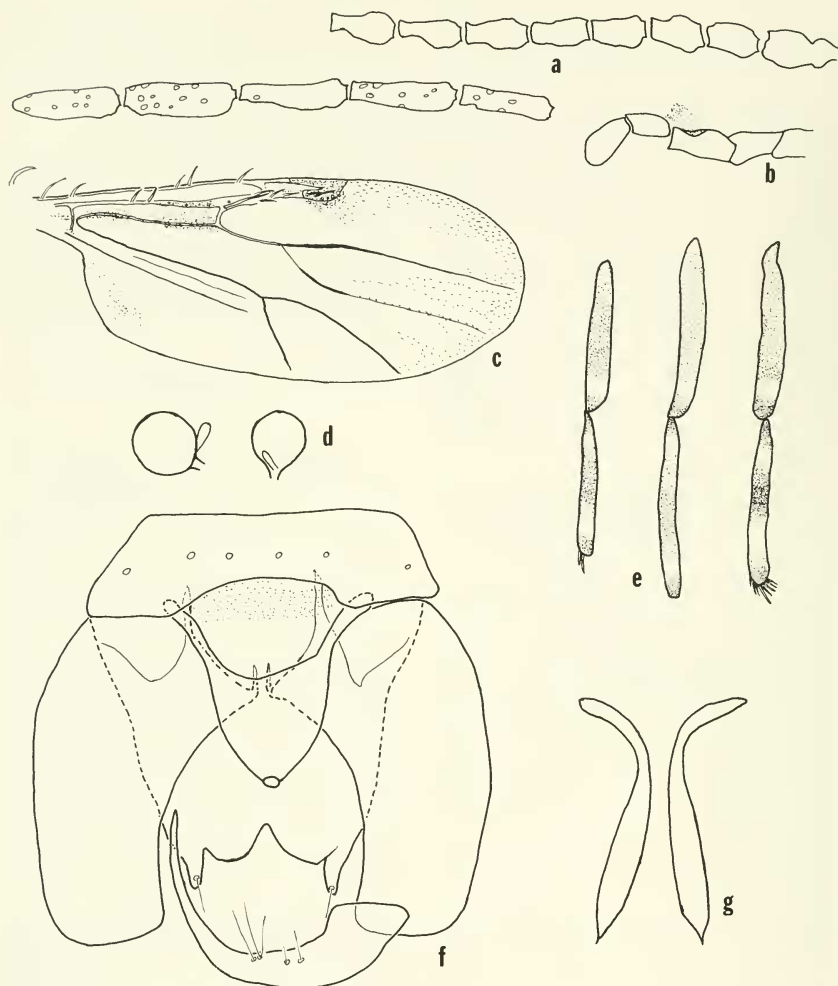


Fig. 3. *Alluaudomyia mouensis* female, a-c: *A. melanesiae*, f-g: a, antenna; b, palpus; c, wing; d, spermathecae; e, femur and tibia of (left to right) fore, mid, and hind legs; f, genitalia, parameres and right gonostylus omitted; g, parameres.

veins; costa and radial veins darker toward bases; two prominent small blackish spots, first dark spot covering apex of costa and vein R4+5, second spot proximad of r-m crossvein extending from vein R to vein M1+2. Costal ratio 0.59; macrotrichia nu-

merous on distal portion of wing. Halter pale.

Abdomen: Dark brown, cerci pale. Spermathecae (Fig. 3d) two, globular with short slender necks; each with moderately long diverticulum; slightly unequal, measuring

0.043 × 0.038 mm and 0.039 × 0.033 mm including necks, diverticula 0.017 mm long.

Male.—Unknown.

Distribution.—New Caledonia.

Types.—Holotype ♀, 1 ♀ paratype, Mt. Mou, 1200 m, 13.ii.1984.

Discussion.—The species takes its name from its habitat at high elevation on Mt. Mou. It is closely related to *A. melanesiae* Clastrier and *A. neocaledoniensis* Clastrier, but can be distinguished from these species by its larger size and darker color with more restricted pale leg markings, features that follow the tendency for animals in cooler habitats and higher elevations to be larger and darker than those in hotter, drier climates.

Alluaudomyia melanesiae Clastrier

Fig. 3f–g

Alluaudomyia melanesiae Clastrier, 1986: 190 (♀; New Caledonia; fig. genital segments, spermathecae, scutellum).

Female diagnosis.—Wing length 0.75 mm, breadth 0.39 mm; costal ratio 0.53. A small dark brown species with whitish scutellum and halteres. Wing pale with slight cloudiness, especially along veins; two prominent small blackish spots in usual location at end of costa and proximad of r-m crossvein. Legs dark brown with narrow pale rings, subapically on femora and at base of hind femur, sub-basally and subapically on fore and mid tibiae, broad base and a broad subapical area on hind tibia pale; hind tarsal ratio 2.74. Female claws slender and unequal, smallest on hind legs, measuring on fore, mid and hind legs 0.070 and 0.032 mm, 0.066 and 0.034 mm, and 0.048 and 0.020 mm respectively. Antenna and palpus short, dark brown; antennal ratio 0.83. Mandible with 9–10 teeth. Spermathecae two, unequal, globose with distinct slender necks, each with moderately long diverticulum; measuring 0.046 × 0.034 mm and 0.030 × 0.030 mm, not including necks.

Male description.—Wing length 0.99 mm, breadth 0.36 mm; costal ratio 0.46. Similar to the female with the usual sexual differ-

ences. Genitalia (Fig. 3f): Ninth sternite with broad shallow caudomedian excavation, ventral membrane with coarse spicules; ninth tergum tapering to short, tapering, hyaline apicolateral processes. Gonocoxite broad basally, the anteromesal corners nearly meeting mesad, curving and tapering to nearly straight, more slender distal portion; gonostylus abruptly curved at base, tapering and evenly curved distally to sickle-shaped, slender, pointed distal portion, 4–5 fine setae borne midway on inner margin. Aedeagus with basal arch rounded and extending to nearly half of total length, main body with slightly convex lateral margins, tapering to slender buttonlike tip bent ventrad. Parameres (Fig. 3g) nearly straight and moderately swollen on proximal half, narrowed distally and evenly curved caudolaterad, ending in slightly broadened, bladellike distal portion.

Distribution.—New Caledonia; originally described from a unique ♀ from Mine Galliéni, 166°20'55"E, 21°54'33"S, 800 m, "maquis haut, sur peridotite."

Specimens examined.—Mt. Dzumac, 760 m, 27.ii.1984, 10 ♀, 6 ♂. Five km E Grand Lac, Plaine des Lacs, 21–25.i.1984, 3 ♂.

Discussion.—The previously unknown male is described from a specimen from Mt. Dzumac. Clastrier (1986) in his key separates *A. melanesiae* from *A. neocaledoniensis* Clastrier by two minor characters: scutellum with two pairs of setae located near midline and the genital sclerotization of the eighth sternite broad and massive in *melanesiae*, and scutellum with two pairs of setae located at lateral ends and genital sclerotization short and linear in *neocaledoniensis*. We have identified our series as *melanesiae* on the basis of the scutellar setae.

Alluaudomyia tillierorum Clastrier

Alluaudomyia tillierorum Clastrier, 1986: 191 (male, female; New Caledonia; figs.).

Female diagnosis.—Wing length 0.93 mm, breadth 0.41 mm; costal ratio 0.53. A moderately large, brownish mottled species

with three prominent small blackish spots on wing; one just before r-m crossvein, second at end of costa and vein R4+5, and third, a linear spot along vein R1. Legs brown with prominent pale bands, narrow and subapical on femora, and broad on tibiae; tibiae yellowish except narrow apices blackish, fore tibia with narrow sub-basal brown ring and broad extensor infuscation at midlength; mid tibia with narrow sub-basal brown ring in midportion; hind tarsal ratio 2.64. Antenna and palpus moderately long, brownish, antennal flagellomeres 2-8 narrowly pale at bases; antennal ratio 0.86; lengths of palpal segments in proportion of 16-30-34-26-33. Eyes bare; mandible with ten teeth. Spermathecae two, globose with distinct slender necks, each with moderately long diverticulum; slightly unequal, measuring 0.050×0.037 mm and 0.043×0.033 mm.

Male diagnosis.—Wing length 0.79 mm, breadth 0.30 mm; costal ratio 0.47. Similar to female with usual sexual differences. Genitalia: Ninth sternum with caudal margin convex, with coarse spicules on membrane subapically; ninth tergum short and tapering, caudal margin weakly bilobed, without distinct apicolateral processes. Gonocoxite arcuate, broad at base, ventral apodemes nearly touching mesad; gonostylus long and curved, sickle-shaped, ending in slender point, 5-5 slender setae scattered along inner margin. Aedeagus with basal arch extending to about a third of total length, main body with convex lateral margins, tapering abruptly on distal third to bluntly pointed tip with angular point turned ventrad. Parameres straight on proximal third, gradually broadened toward midportion, then abruptly narrowed and continued as apically swollen, fingerlike process directed slightly ventrolaterad.

Distribution.—New Caledonia. Originally described from 1 ♂ (holotype) and 7 ♀ from Vallée de la Ouinné, 730 m, humid *Araucaria* forest; upper trail of the Rivière

Bleue, 230 m in humid forest; and Mine Galliéni 800 m, high scrub on peridotite.

Specimens examined.—Mt. Dzumac, 760 m, 14-17.i.1984, 2 ♂, 5 ♀; same, 27-28.ii.1984, 4 ♂, 5 ♀. Five km E Grand Lac, Paline des Lacs, 300 m, forest, 22-25.ii.1984, 1 ♀. Ponandou River, 5 km S touho, 100 m, 22.ii.1984, 1 ♂.

ACKNOWLEDGMENTS

We are grateful to the collectors, Michael G. Pogue and Marc Epstein, for paying special attention to the collection of ceratopogonids at their UV light while in new Caledonia, and to Donald W. Davis for calling to their attention our interest in New Caledonia biting midges. We also thank Edwin F. Cook of the University of Minnesota for permission to retain and study the New Caledonia collections, made while Michael Pogue was on a travel grant from the University of Minnesota. William L. Peters of Florida Agricultural and Mechanical University at Tallahassee kindly provided maps of New Caledonia and much helpful literature and information on its insect fauna.

LITERATURE CITED

- Clastrier, J. 1986. Ceratopogonidae de la Nouvelle-Calédonie IV. Genre *Alluaudomyia* (Diptera, Nematocera). Description de six espèces nouvelles; simplification de l'identification des femelles. Cah. ORSTOM Ser. Entomol. Med. Parasitol. 23: 187-201.
- Debenham, M. L. 1971. Australasian Ceratopogonidae (Diptera: Nematocera). Part XV: The genus *Alluaudomyia* Kieffer in Australia and New Guinea. Proc. Linn. Soc. N.S.W. 96: 128-174.
- Downes, J. A. and W. W. Wirth. 1981. Ceratopogonidae [chapter] 27, pp. 393-421. In McAlpine, J. F. et al., eds., Manual of Nearctic Diptera. Vol. 1. Res. Branch Agric. Can. Ottawa. Monograph 27: 674 pp.
- Spinelli, G. R. and W. W. Wirth. 1984. The Neotropical predaceous midges of the genus *Alluaudomyia* (Diptera: Ceratopogonidae). Proc. Entomol. Soc. Wash. 86: 673-702.
- Tokunaga, M. 1963. New Guinea biting midges (Diptera: Ceratopogonidae). 3. Pac. Insects 5: 211-279.
- Tokunaga, M. and E. K. Murachi. 1959. Insects of

- Micronesia (Diptera: Ceratopogonidae). Insects Micronesia 12: 103-434.
- Wirth, W. W. and M. D. Delfinado. 1964. Revision of the Oriental species of *Alluaudomyia* Kieffer (Diptera, Ceratopogonidae). Pac. Insects 6: 599-648.
- Wirth, W. W. and N. Marston. 1968. A method for mounting small insects on microscope slides in Canada balsam. Ann. Entomol. Soc. Am. 61: 783-784.